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Hydrological assessment of radar-raingauge merging techniques using the Grid-to-Grid model

Paul S. Mattingley, Robert J. Moore, Steven J. Cole, Steven C. Wells, and Kevin B. Black
Centre for Ecology & Hydrology, Wallingford, United Kingdom (paumat@ceh.ac.uk)

High quality space-time grids of rainfall are required as input to achieve accurate predictions of river flow for operational flood forecasting. In order to produce the best possible rainfall inputs it is common practice to merge observational data from raingauge and radar networks to obtain improved gridded rainfall estimates.

The relative performance of merging methods is commonly assessed at radar pixels coincident with raingauge locations employing evaluation statistics such as the cross-validated Root Mean Square Error (RMSE). Such assessments indicate the extent to which the merged rainfall estimate can reproduce the raingauge value omitted at each cross-validation step and given time but not whether this leads to improved hydrological model performance.

Here, results of a UK case study will be presented that demonstrate the differences in hydrological performance between the selected merging methods. A spatially distributed hydrological model, called Grid-to-Grid or G2G, is used to simulate river flows across several major flood events over the 6 years 2007 to 2012.

G2G is applied operationally across Britain by the Flood Forecasting Centre and Scottish Flood Forecasting Service. The current real time set-up employs 1km gridded rainfalls at a 15 minute interval obtained using a static multiquadric merging approach where any incidental parameters are calibrated off-line. Here, the current merging method is compared with adaptive multiquadric merging and variants of Kriging.

Attention is focussed on whether a reduction in rainfall estimation RMSE necessarily leads to improvement in modelled river flow, when judged in terms of flow R^2 Efficiency, magnitude and timing of peak flows, and overall flow bias. Discussion of computational time and algorithm complexity is included to guide recommendations for improvements to the current operational use of rainfall merging methods.